II. Longitudinal impedance measurements

In Fig. 1, the longitudinal coupling impedance of the cavity, set on the first harmonic, is shown. In Fig. 2 the second harmonic case is shown. This case is obtained by removing three, out of four, lumped capacitance in parallel to the cavity gaps. The main resonance is at 846 kHz for the first harmonic case, and not at the correct 1.058 MHz, because of the absence of ferrite bias.

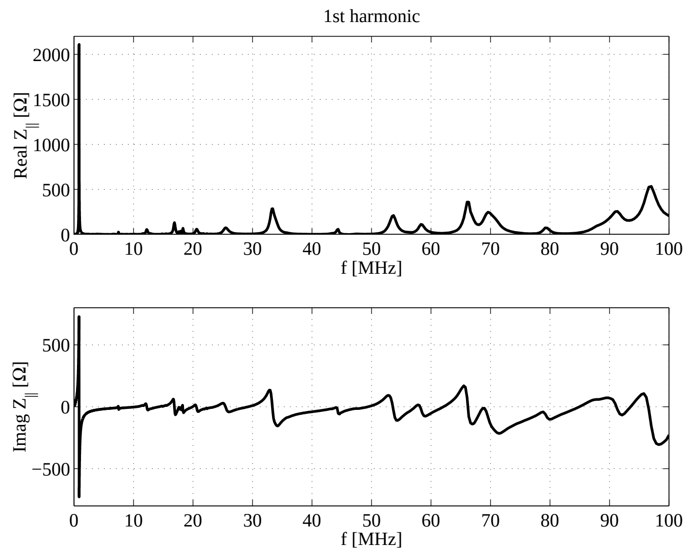

Fig. 1. Longitudinal impedances of the cavities, set on the first harmonic.

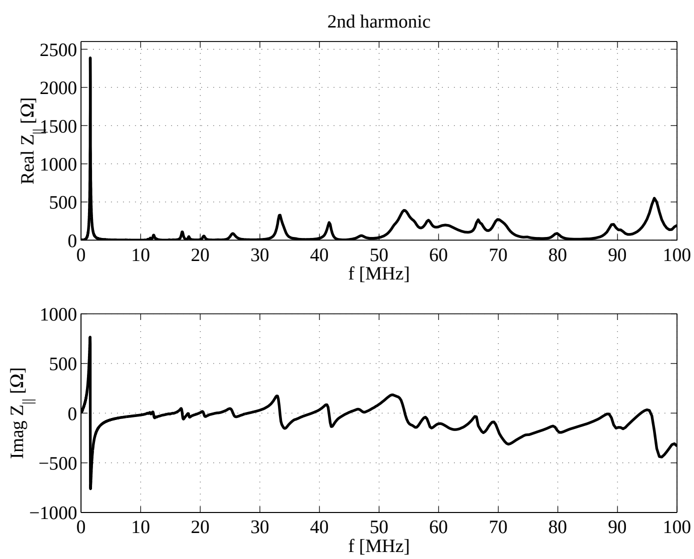

Fig. 2. Longitudinal impedances of the cavities, set on the second harmonic.

In Fig. 3 and 4, the cases of gaps shorted by means of a safety switch are shown for first and second harmonic cavity. One can see that the main resonance is shifted of the same amount when one gap, out of two, is shorted and this means that the cavity are symmetric and in parallel, without any bus-bar induced phase shift. When both gaps are shorted the mode is still present and the shift is larger. WHY??

The effect on the higher order modes is only present as a change in the shunt impedance for some of them. None of them has a frequency shift.

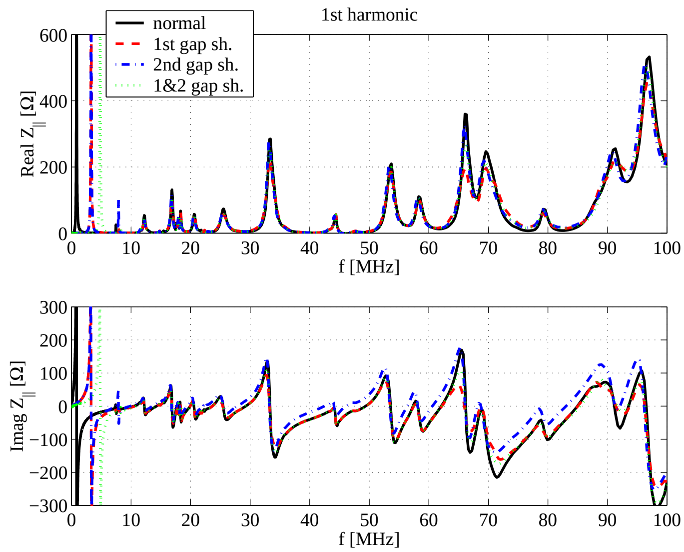

Fig. 3. Longitudinal impedances of the cavities, set on the first harmonic, short-circuited gaps.

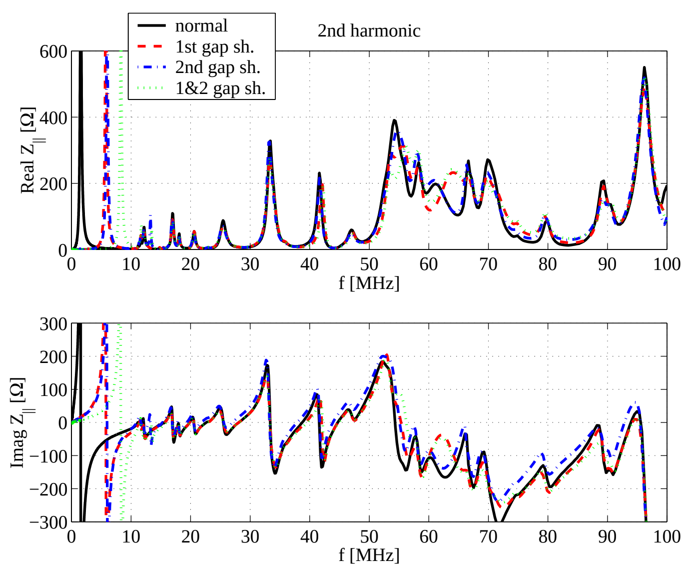

Fig. 4. Longitudinal impedances of the cavities, set on the second harmonic, short-circuited gaps.

In Fig. 5 and 6, it is shown the longitudinal impedance, normalized to the revolution frequency 1.058 MHz. The high order modes are located at: 7.47 MHz and 3.75Ω shunt impedance; 12.24 MHz, 4.8Ω; 16.88MHz, 8.33Ω; 18.32MHz, 3.94Ω; 20.6 MHz, 3.06 Ω; 25.05MHz, 3.08Ω; 33.3 MHz, 9.07Ω.

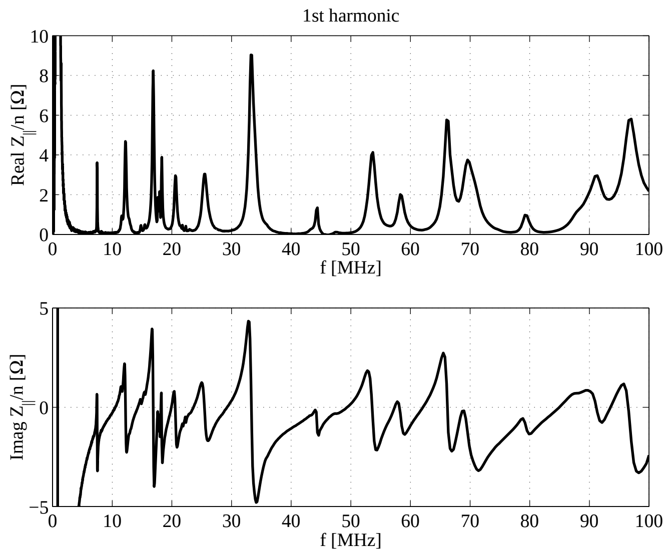

Fig. 5. Longitudinal impedances of the cavities, set on the first harmonic, normalized to the revolution frequency 1.058 MHz.

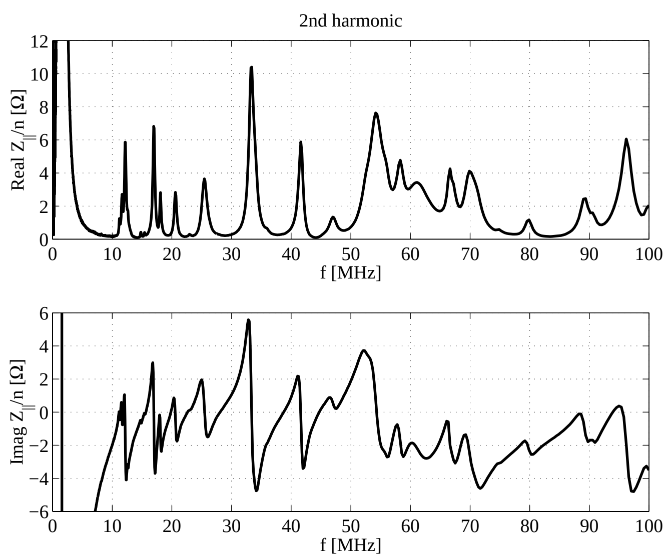

Fig. 6. Longitudinal impedances of the cavities, set on the second harmonic, normalized to the revolution frequency 1.058 MHz.

III. Transverse coupling impedance measurements

The transverse coupling impedance has been measured by means of a homemade two-wire cable. The reference is measured with the two-wire in air, <u>without</u> any reference beam pipe. This is the probable cause of a ratio between the transmission coefficients larger than the unity, leading to conceptually wrong impedance with a negative real part. Also, a sort of amplitude modulation is present along the frequency range and this may be due to longitudinal resonances along the cable together with different phase velocity in air and in the cavities.

In spite of that, a resonant mode is clearly visible at about 17.6 MHz when the cavity is in the first harmonic configuration and the cable plane is horizontal. From the imaginary part, a shunt impedance of 3.64Ω (difference between maximum and minimum impedance), and a quality factor of 100 (related to the difference in frequency of the two peaks) are measured. The second harmonic configuration does not give that mode, or it is not present in the measured frequency range. No significant impedance is measured with the cable in the vertical direction.

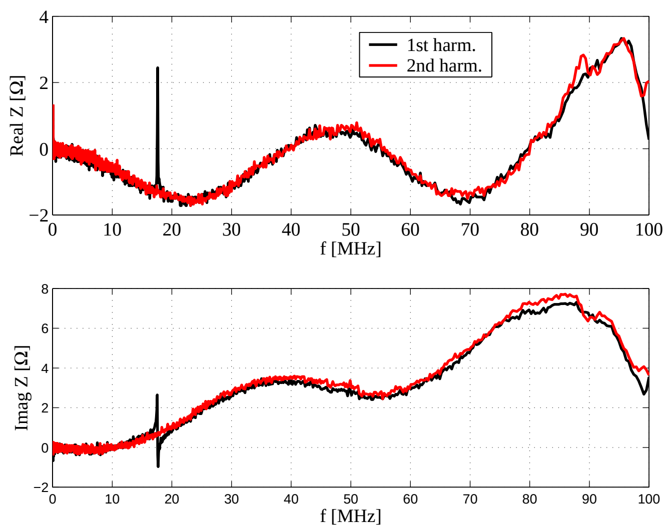

Fig. 7. Measured impedance of the two cavities. The impedance is <u>not</u> divided by the wire spacing and the frequency.

An equivalent analytical expression for that resonance is:

$$Z_{tr} = \frac{c}{\omega\Delta^2} R\left[1 + jQ\left(f / f_0 - f_0 / f\right)\right]^{-1} \qquad (2)$$

where R =3.64 Ω , Q =100 and f_0 =17.6 MHz and Δ =41.3 mm for the measured prototype.